SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Update on Climate Change and Water Management in South Florida

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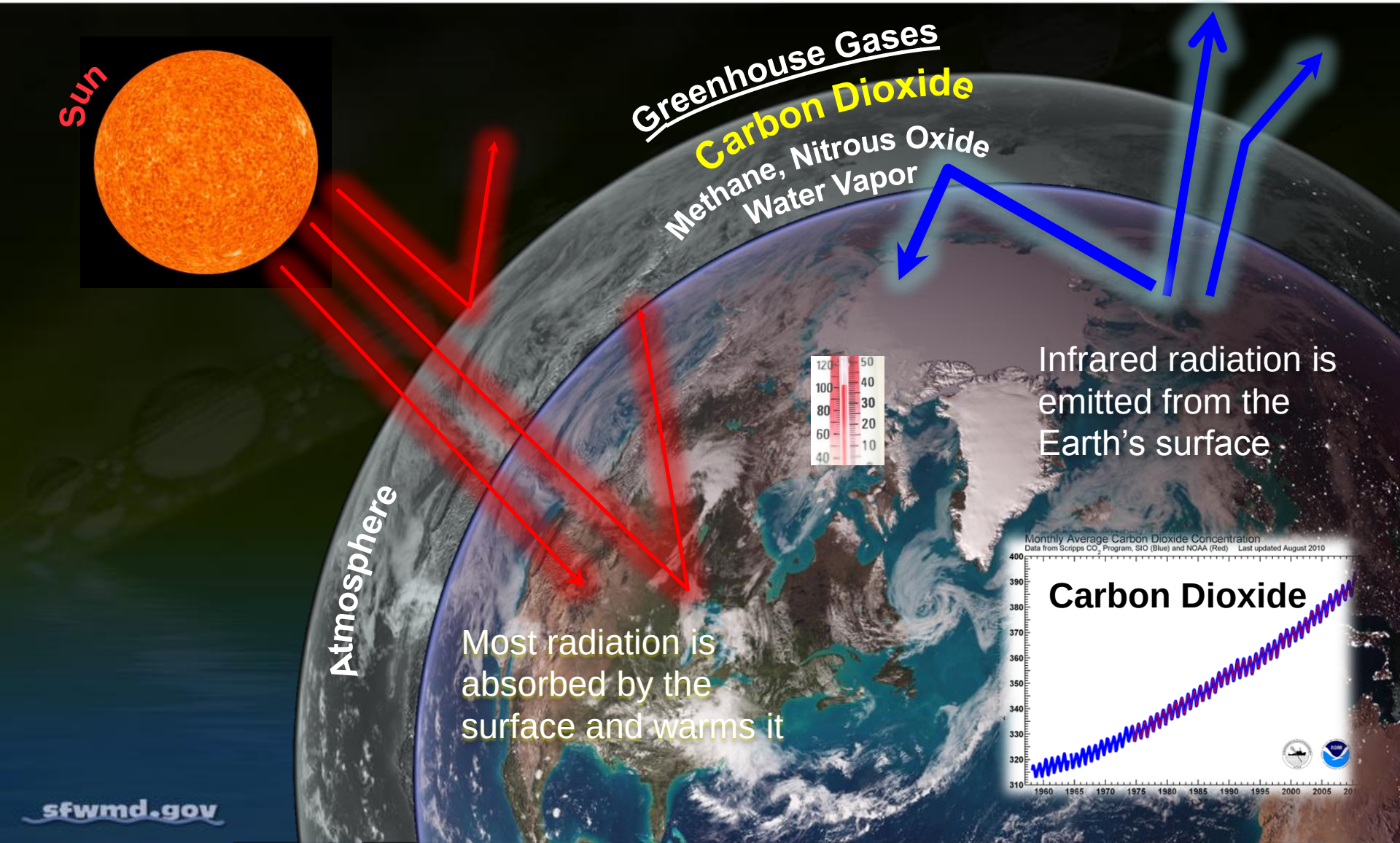
Governing Board Workshop
November 09, 2010

sfwmd.gov

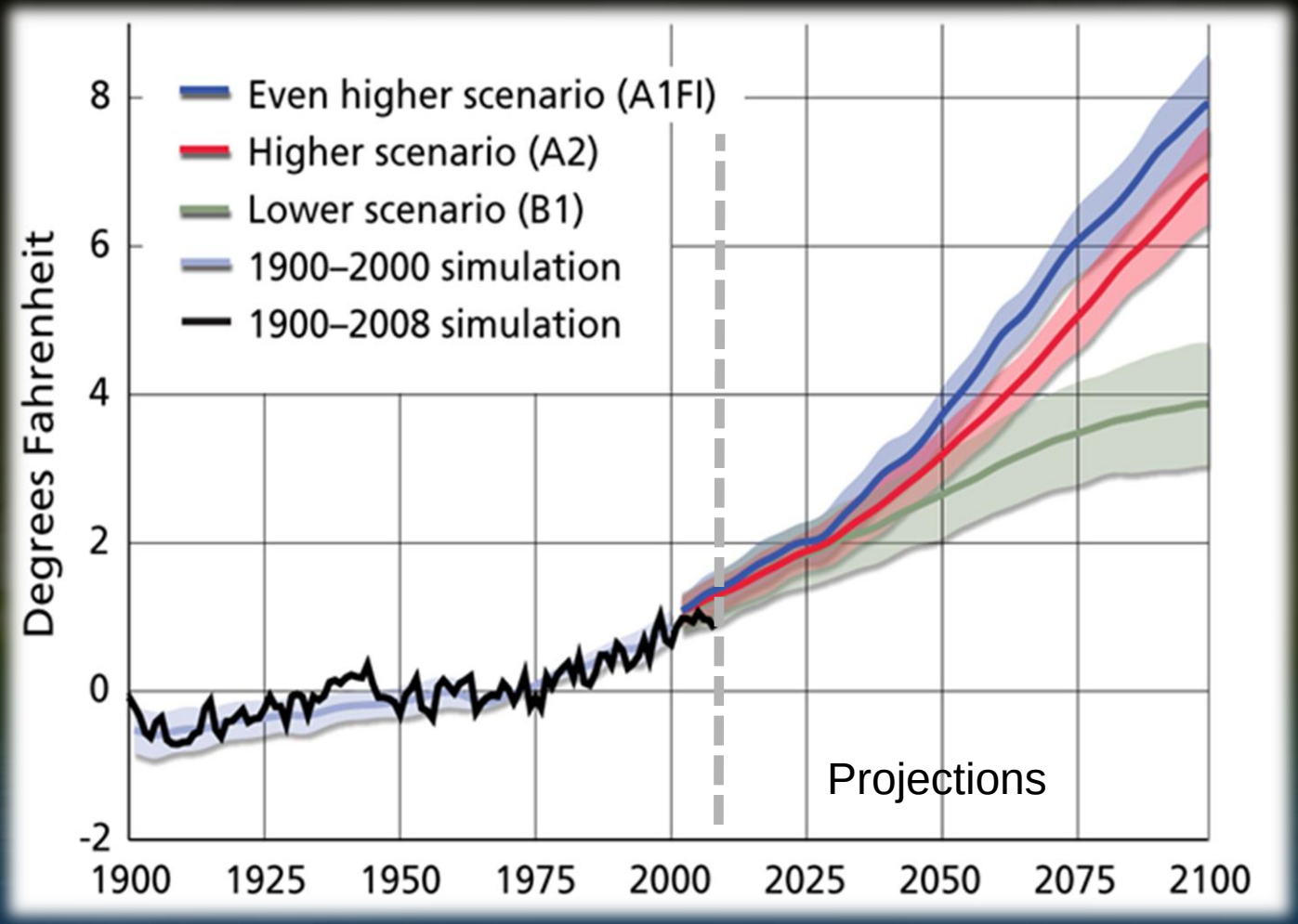
Outline

- Causes of climate change & sea level rise
- Attribution of recent climate events
- Projecting sea level rise
- Climate change impacts to water management
- Regional coordination update
- Proposed future efforts

Green House Gas Effect - Warming (too much of a good thing!)



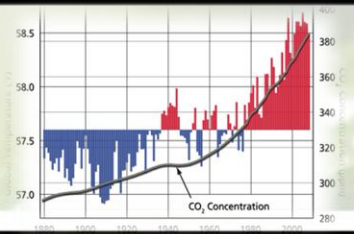
Temperature Projections



Changes are relative to 1960-1979 average

United States Global Change Research Program

Signs of a warming world



Air Temperature Near Surface (Troposphere)

Humidity

Glaciers

Temperature Over Oceans

Snow Cover

Sea Surface Temperature

Sea Level

Sea Ice

Temperature Over Land

Ocean Heat Content

United States Global Change Research Program

Current & Evolving Climate Conditions:
Attribution

IT'S OFFICIALLY...

OUR HOTTE
SUMM VER

In the West Palm Beach area, the daily high reached or exceeded 90 degrees on 79 da

Lows hovered above 80 degrees on 25 days to set a re

Will warming

Downtown Los Angeles bakes at record 11

By JOHN ANTCZAK, Associated Press Writer
Mon Sep 27, 6:14 pm ET

Water cycle seems out of whack, experts find

18 percent more water fed into oceans in 2006 than in 1994, satellite data show

10/7/2010 MSNBC

Steaming in South Florida

Average summer 2010 temperatures and the hottest days in South Florida:

PALM BEACH
84.6°
2.4 degrees above normal
Previous record:
84.2° (1998)

HOTTEST DAYS:
West Palm Beach
96°
July 12 and 30

After South Florida's driest October on record, water district urges conservation

By **ANDREW MARRA**
Palm Beach Post Staff Writer

Posted: 7:54 p.m. Monday, Nov. 1, 2010

Post a Comment | E-mail | Print | Larger Type

Last month was the driest October on record in South Florida, meteorologists said, underscoring concerns about local water shortages this winter.

Coastal street flooding during high tide

Miami-Dade County
Credit: Miami-Dade DERM

Attribution Science Workshop (NOAA & NSF)

Aug 2010 Pakistan

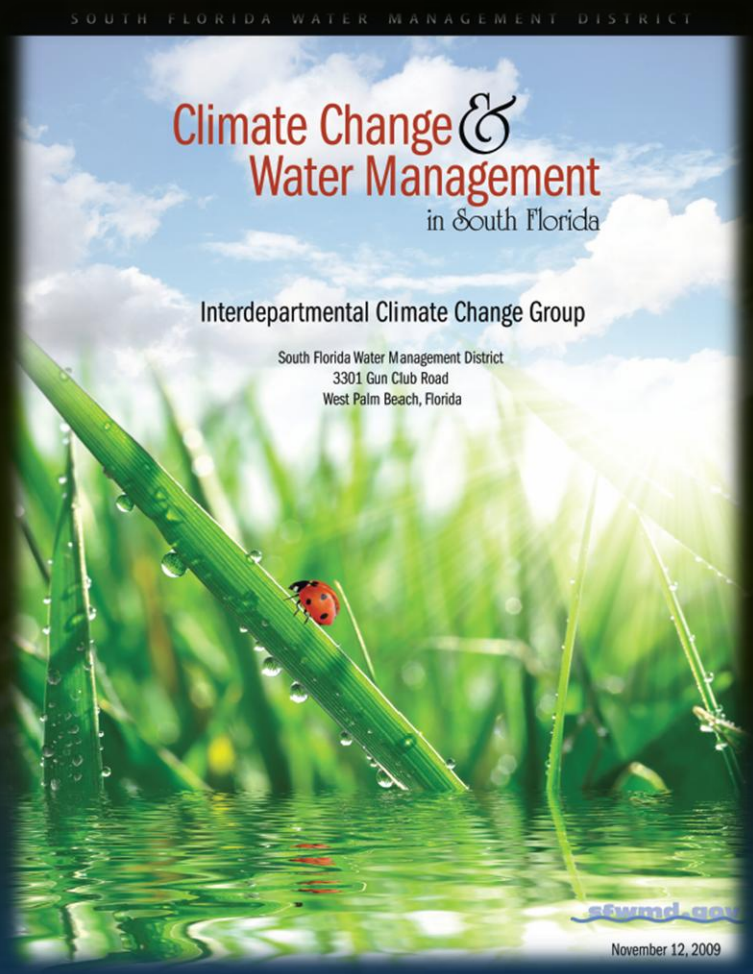
Russia

China

Science of explaining a detected change: human induced or natural variability?

- *What are the science requirements and capabilities for near real-time attribution?*
- *Who needs climate attribution, and how can attribution information be communicated?*

SFWMD White Paper & Strategy



- **Two Important Questions:**
  - **Which decisions are likely to be affected and could benefit from adaptation strategies (Type I) in the short term?**
  - **Which decisions are likely to be affected but for which adaptation strategies (Type II) could be deferred without serious consequences?**

Potential Climate Change Impacts to SFWMD

Climate Change Drivers

Natural Cycles
Interannual
(e.g. El Nino and La Nina) to
Multi-decadal
(e.g. AMO*)

Human Induced
Land use changes
Greenhouse gases
->Global Warming

Quartet of change: Stressors

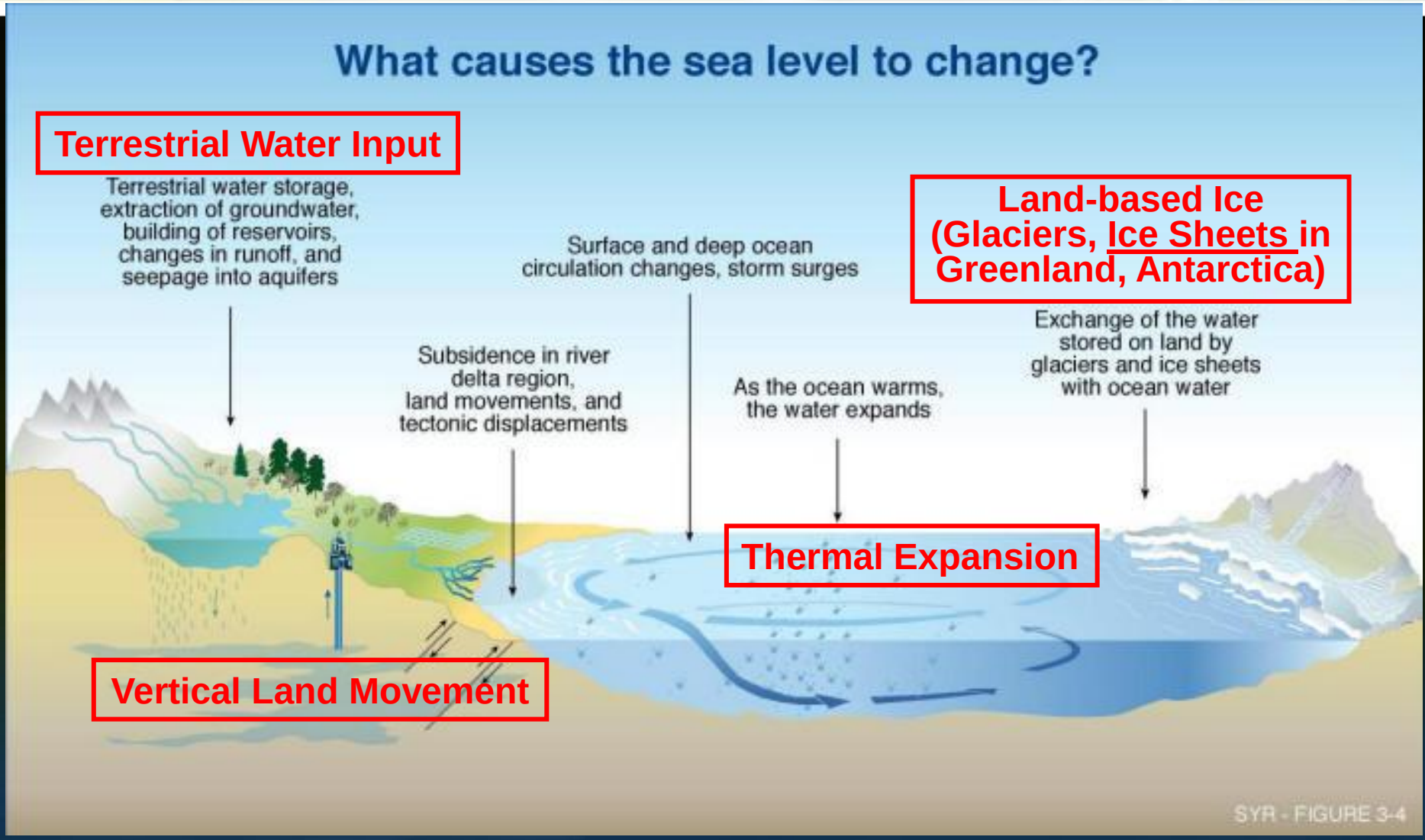
- **Rising Seas**
- **Temperature**
- **Rainfall, floods, and droughts**
- **Tropical Storms & Hurricanes**

Water Management Impacts

- **Direct landscape impacts (e.g. storm surge)**
- **Water Supply (e.g. droughts, saltwater intrusion)**
- **Flood Control (e.g. urban flooding, hurricanes)**
- **Natural Systems (e.g. ecosystem impacts, both coastal and interior)**

*Atlantic Multi-decadal Oscillation of temperature in the Atlantic Ocean

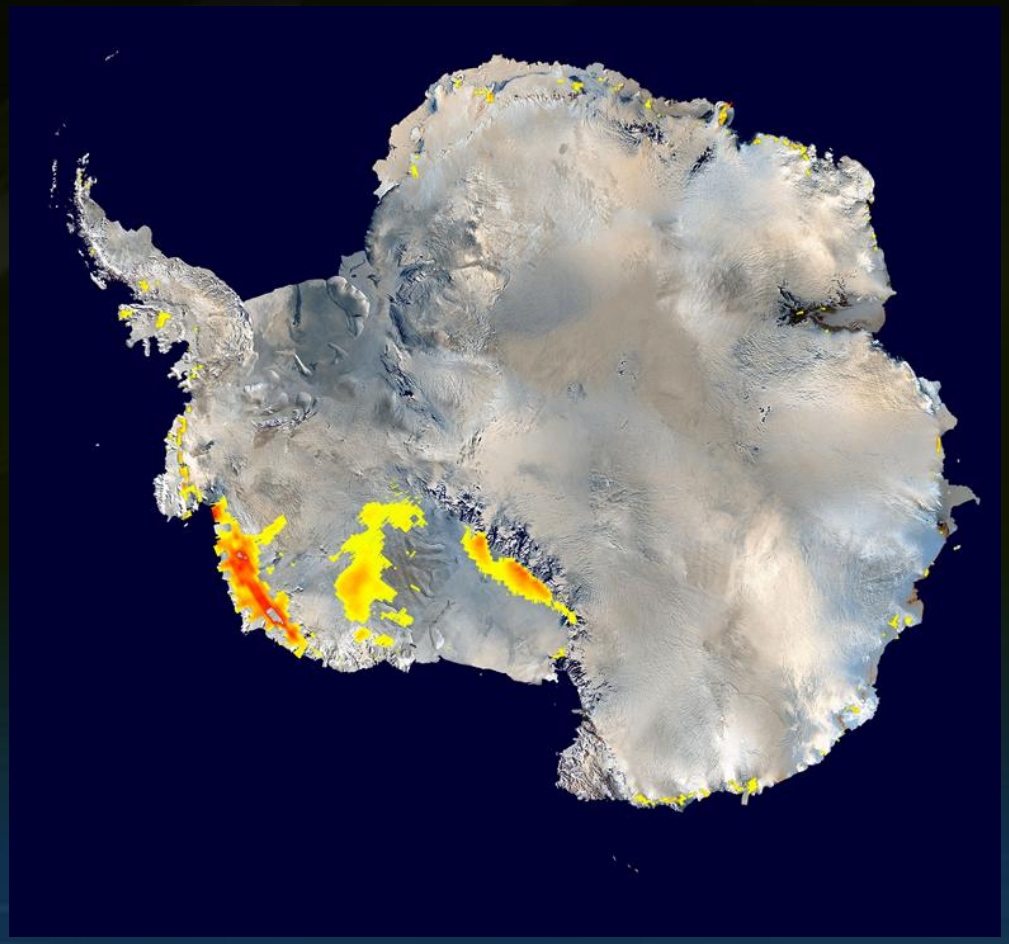
Sources of Sea Level Rise



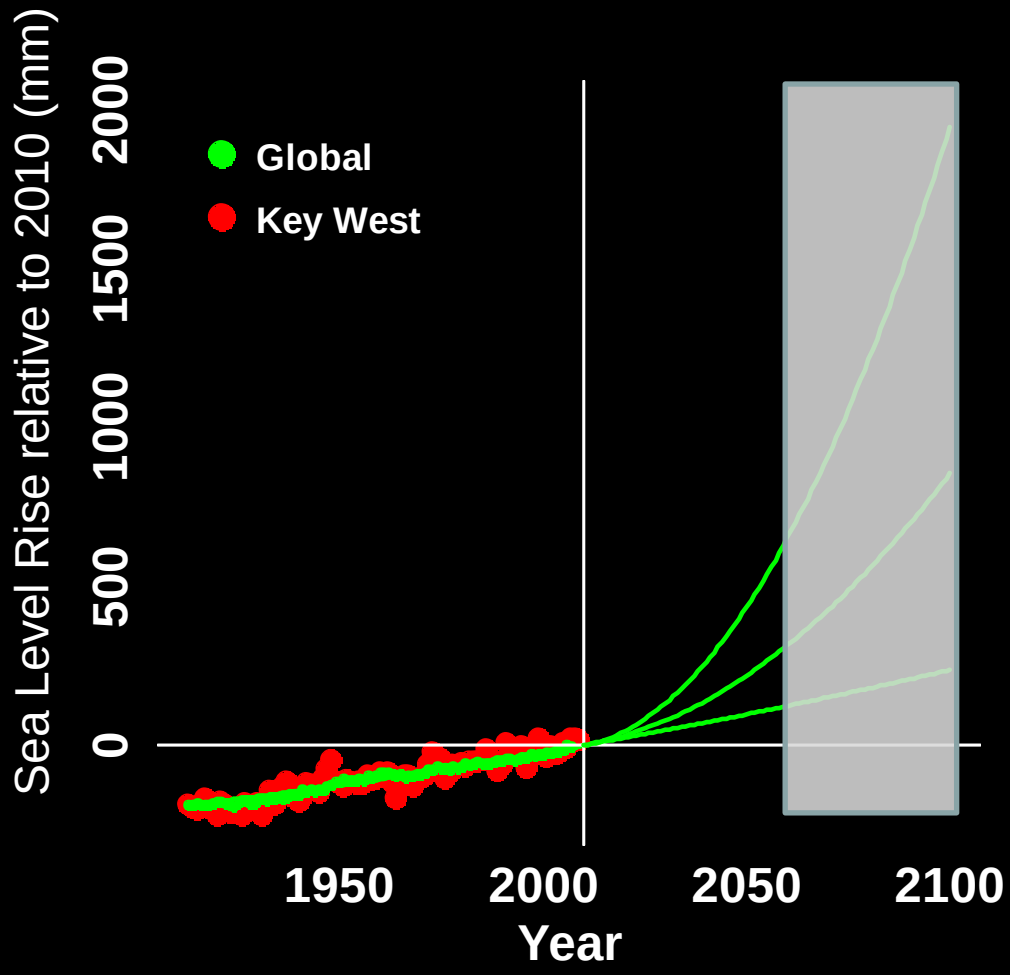
Future Projections of Sea Level Rise: Polar Ice Uncertainty

Greenland
(~ 2 million sq.km.)

Antarctica
(~5.4 million sq. km.)



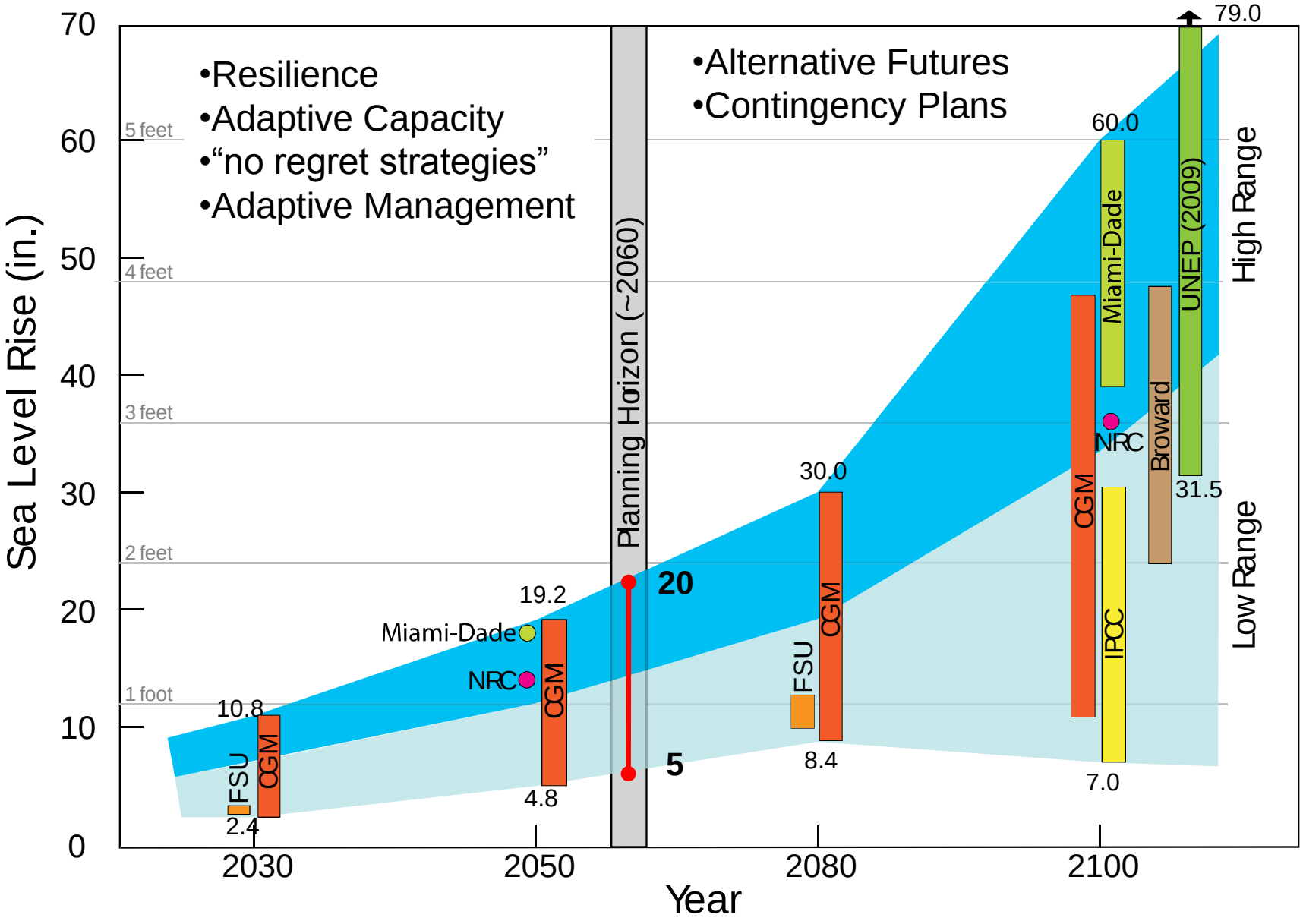
What is the future rate of acceleration?



Rapid acceleration due to ice sheet loss

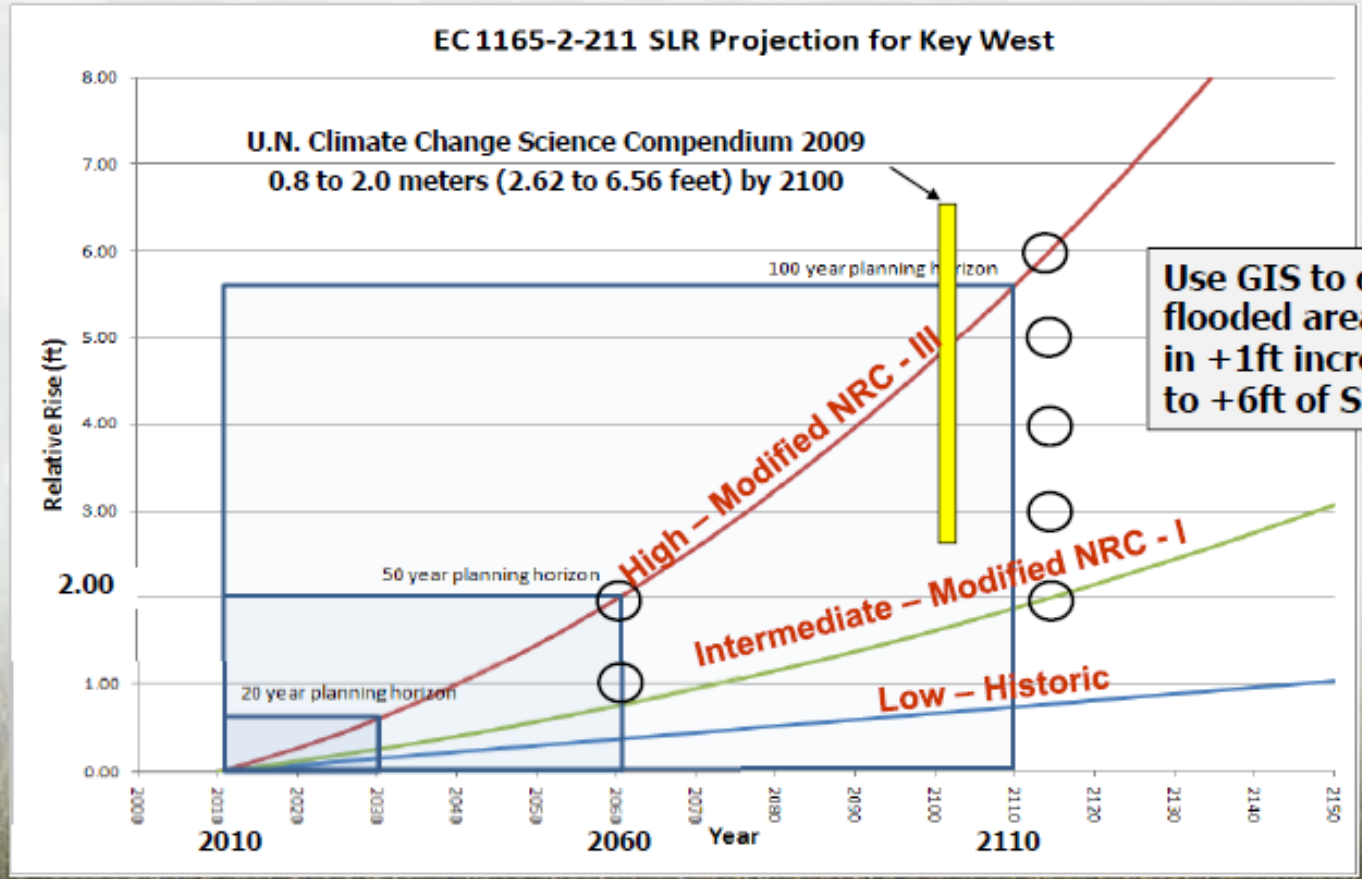
Medium acceleration

Continuing current trend


•Resilience
•Adaptive Capacity
•"no regret strategies"
•Adaptive Management
•Alternative Futures
•Contingency Plans
Planning Horizon (~2060)
Sea Level Rise (in.)
Year
High Range
Low Range
5 feet
4 feet
3 feet
2 feet
1 foot
70
60
50
40
30
20
10
0
2030
2050
2080
2100
10.8
FSU
CGM
2.4
19.2
Miami-Dade
NRC
CGM
4.8
20
5
30.0
FSU
CGM
8.4
79.0
60.0
Miami-Dade
NRC
CGM
IPCC
7.0
Broward
UNEP (2009)
31.5

USACE National Guidance

Scenarios for Sea-Level Rise



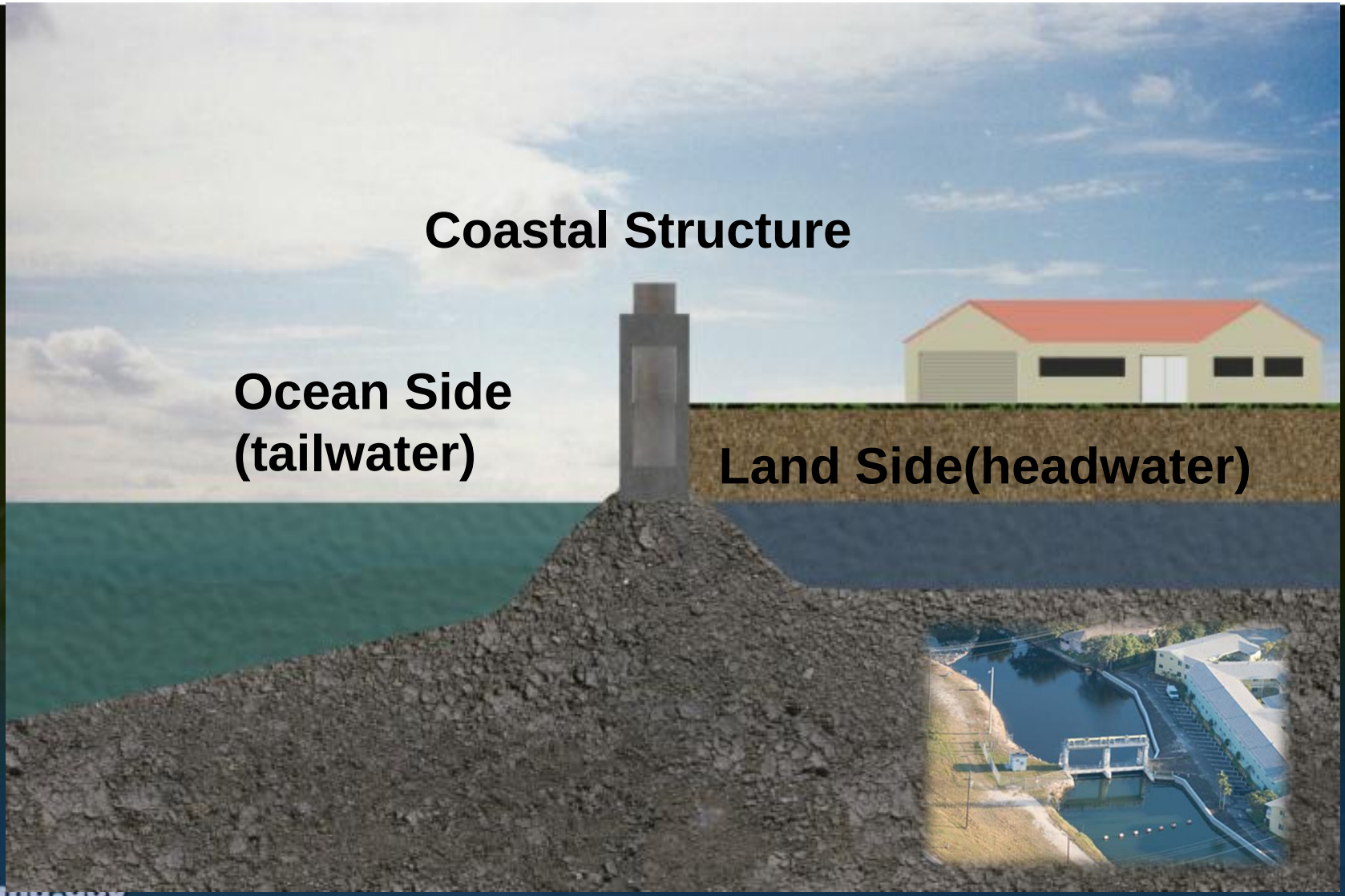
Unifying local projections – coordination through Southeast Climate Compact

- Technical workgroup:
  - Climate Task Force committee members from Miami-Dade, Broward, Palm Beach, and Monroe
  - Florida Atlantic University, Florida International University, University of Miami
  - U.S. Army of Corps of Engineers
  - South Florida Water Management District
  - NOAA
- Emphasis on projections based on peer-reviewed science. SFWMD will request that the final projections be peer reviewed.

Model Development

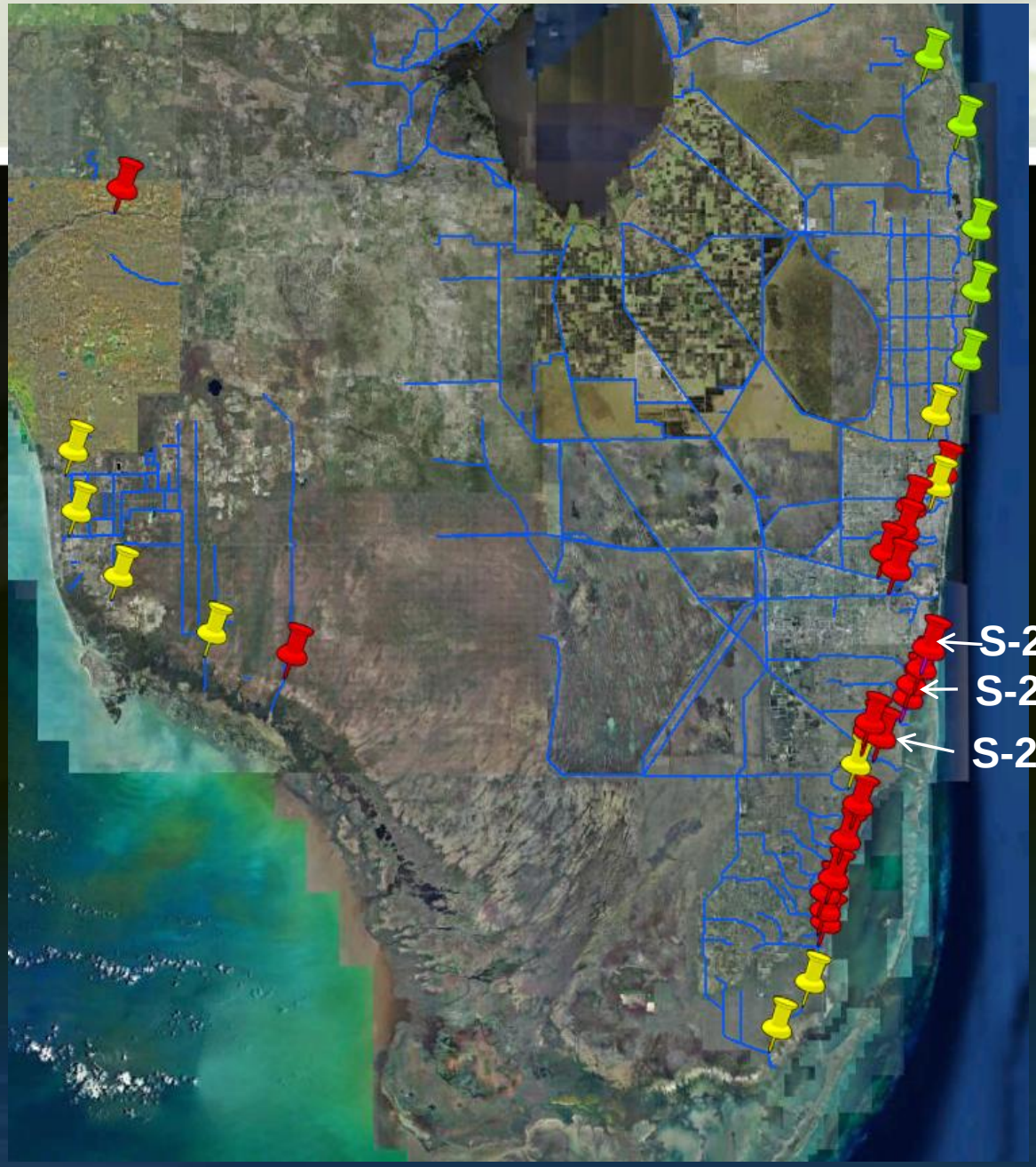
- **Flood Protection**
  - **Working with the Hydrologic Engineering Center of the U.S. Army Corps of Engineers to develop a surface water/groundwater model. Currently the model is being tested in the C-4 Basin**
- **Water Supply**
  - **USACE, DOI and SFWMD collaborating on the development of saltwater intrusion models for the coastal belt.**
    - **West coast model under development by our Big Cypress Basin office**

Impacts of Rising Seas: Flood Control



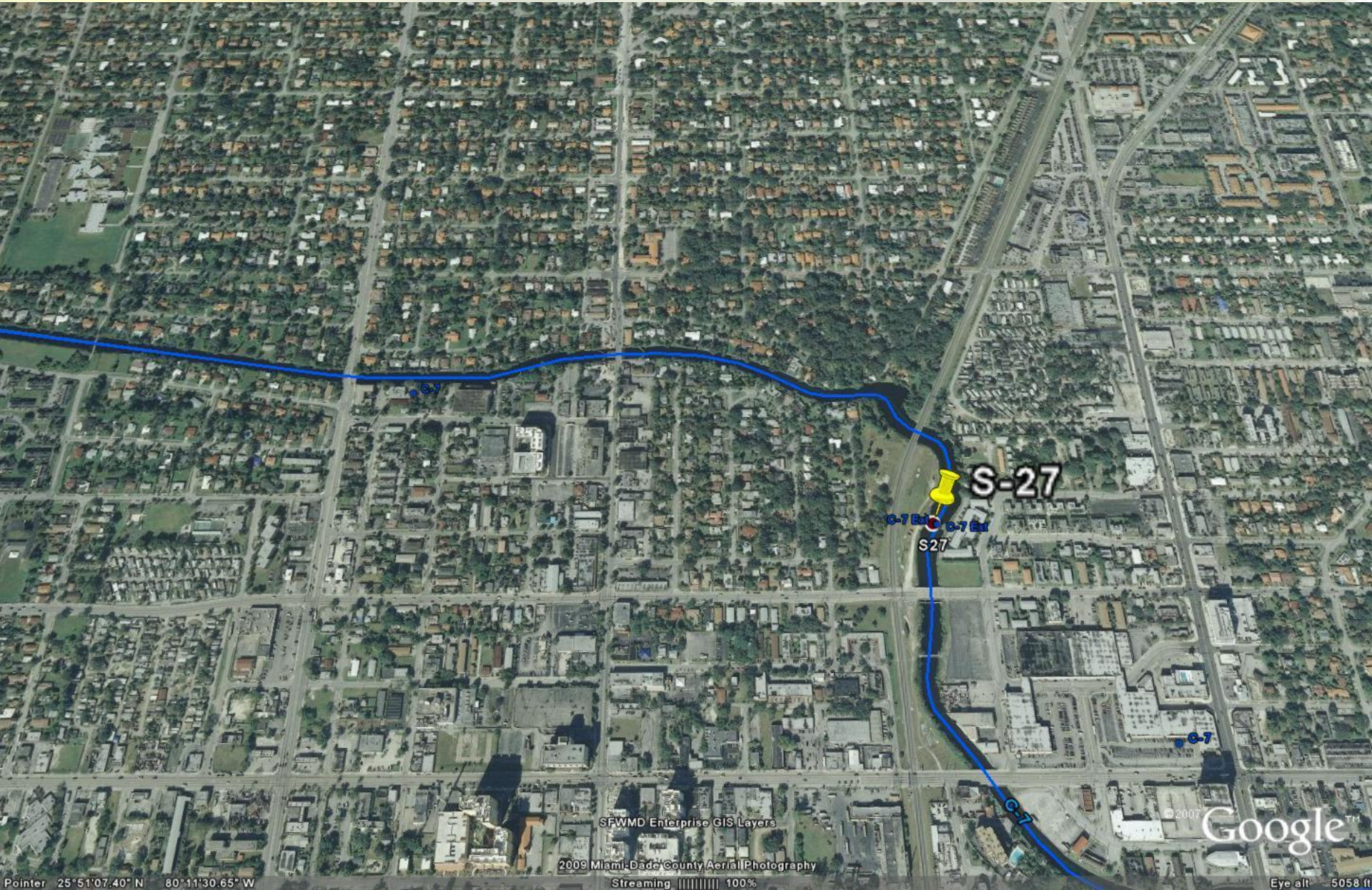
Vulnerable Structures

- Preliminary review based on original designs
- 28 gravity structures on the East Coast
- Six gravity structures on the west coast
- Most vulnerable structures are in Miami-Dade and Broward counties
  - Prioritized 3 structures



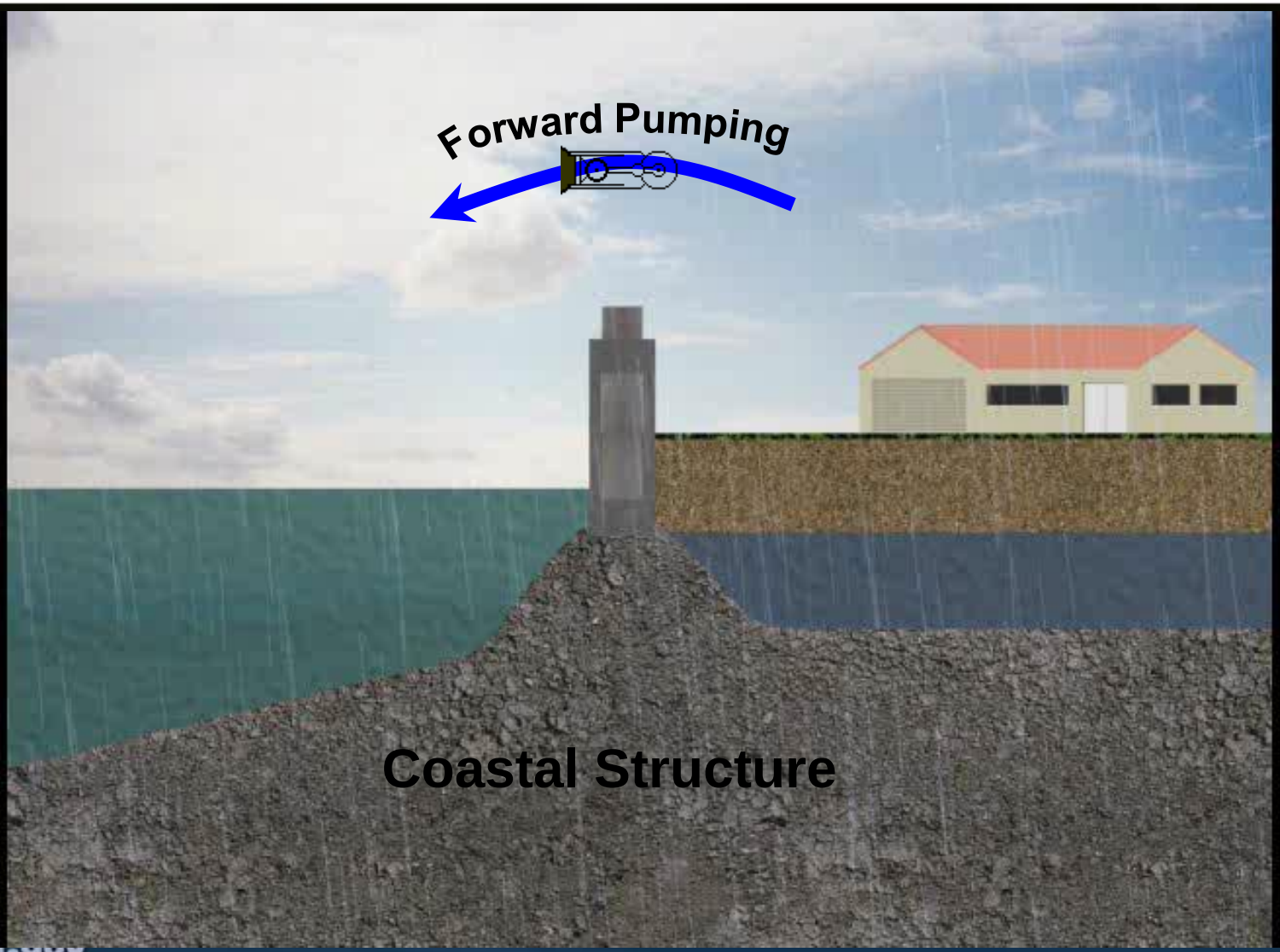
Priority Structures: S-27, S-28, and S-29 Coastal Spillways

Area Surrounding S-27 Structure



Adaptation to Rising Seas
Example: Forward Pumping at S-26 Structure

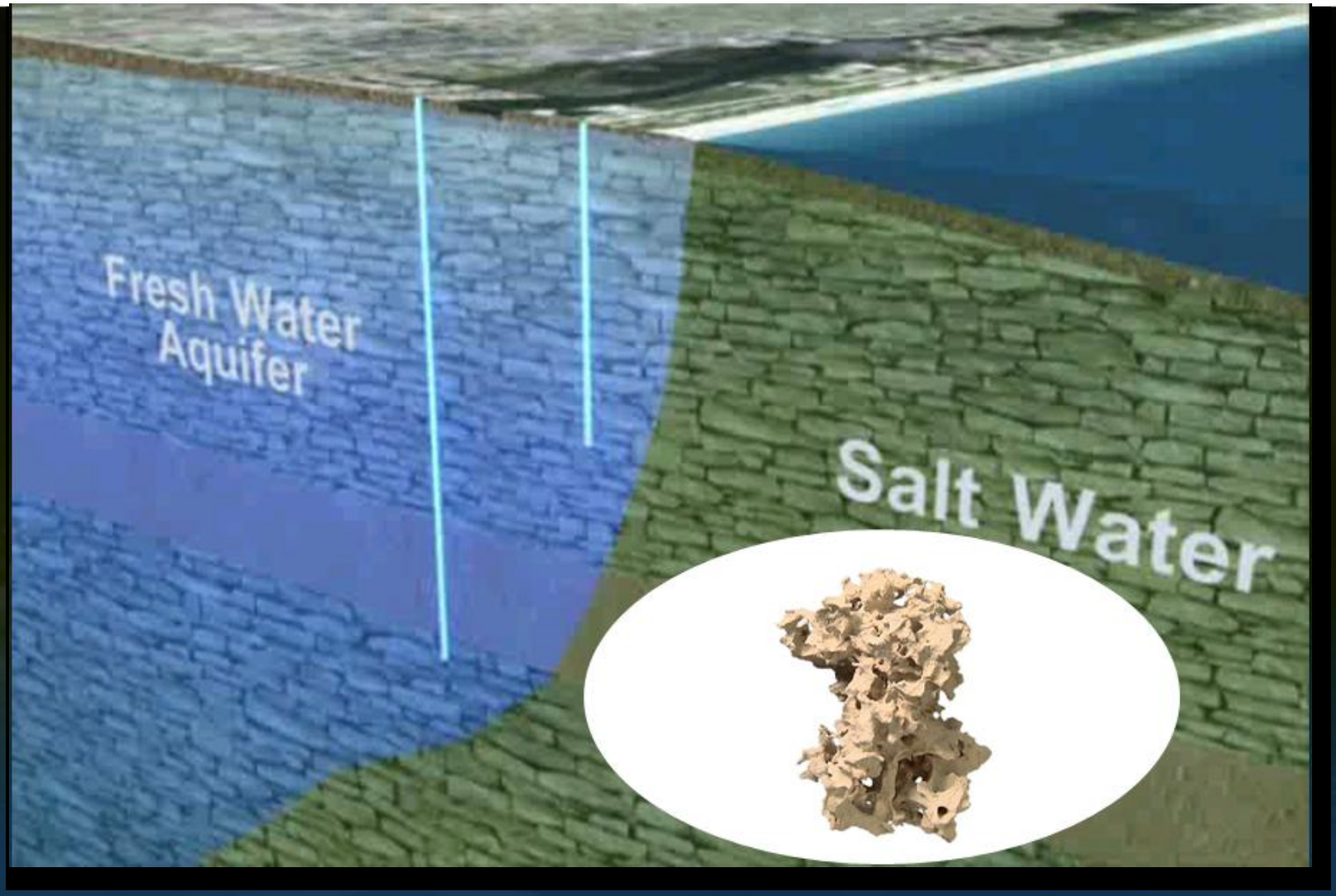
Rising Seas
Adaptation - Forward Pumping



Potential Impact of Rising Seas: Southern Everglades

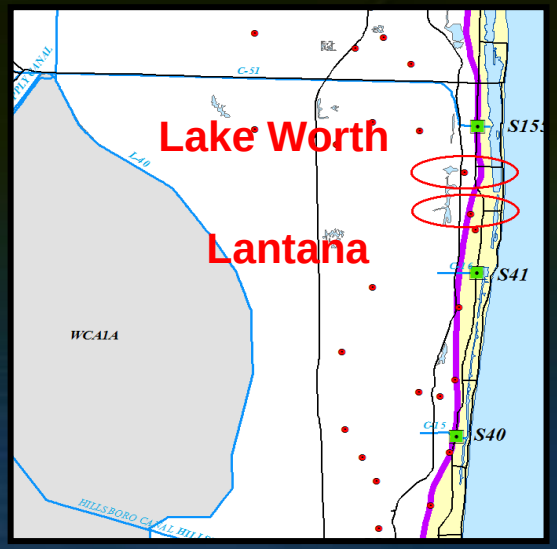
- Relocation and possible reduction of mangrove forests
- Forced migration of wading birds northward
- Potential peat collapse, coastal erosion, and redistribution of sediments
- Salinity intrusion into freshwater marshes can: discharge toxic hydrogen sulfide, cause coastal fish kills, and increase habitat loss

Rising Seas - Water Supply: Saltwater Intrusion



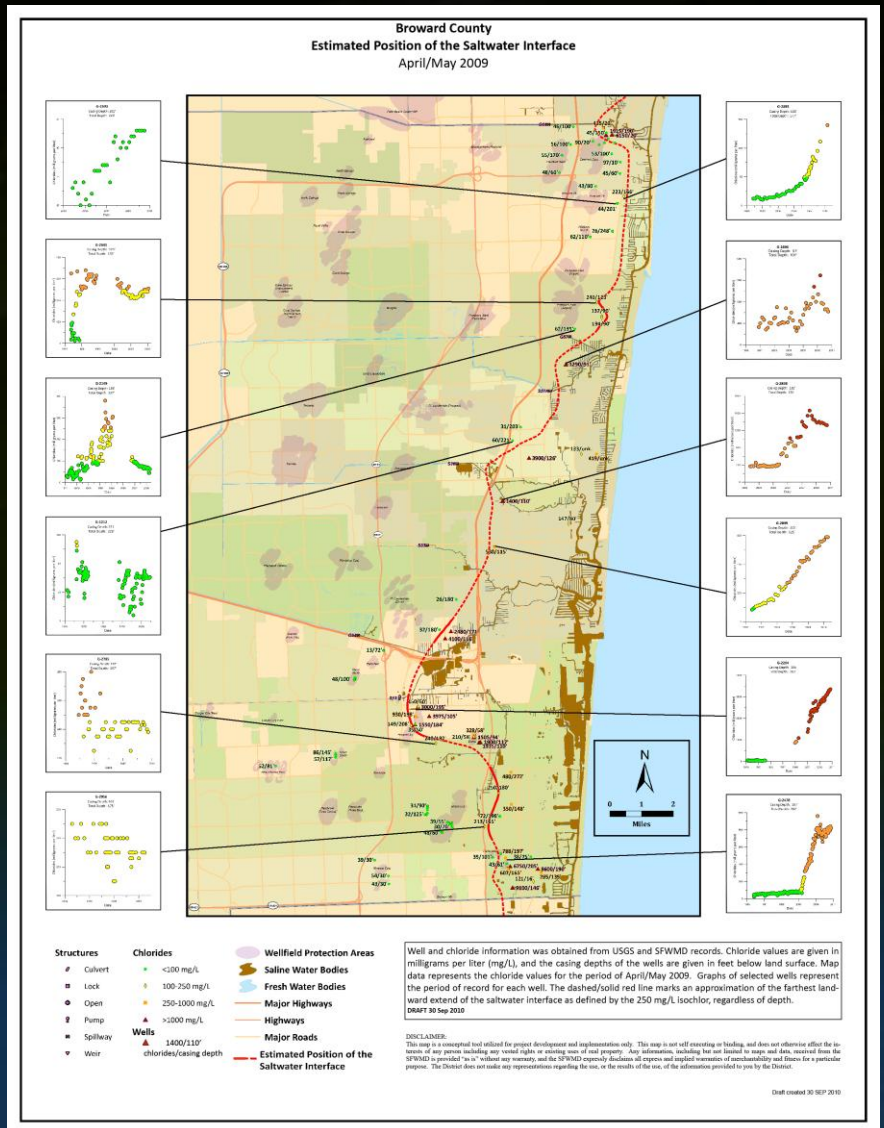
Saltwater - Groundwater Interface

- Review groundwater monitoring network used to develop the map of the saltwater-groundwater interface
  - Identify gaps
  - Develop costs for new groundwater monitoring wells
  - Identify utilities at risk



Saltwater Intrusion Mapping and Monitoring Network Evaluation

- FY10 - developed draft saltwater intrusion maps for Broward, Palm Beach, Martin and St. Lucie Counties
- FY11 - develop saltwater interface maps for Lower West Coast aquifer
- FY11 - evaluate and make recommendations on existing monitoring network

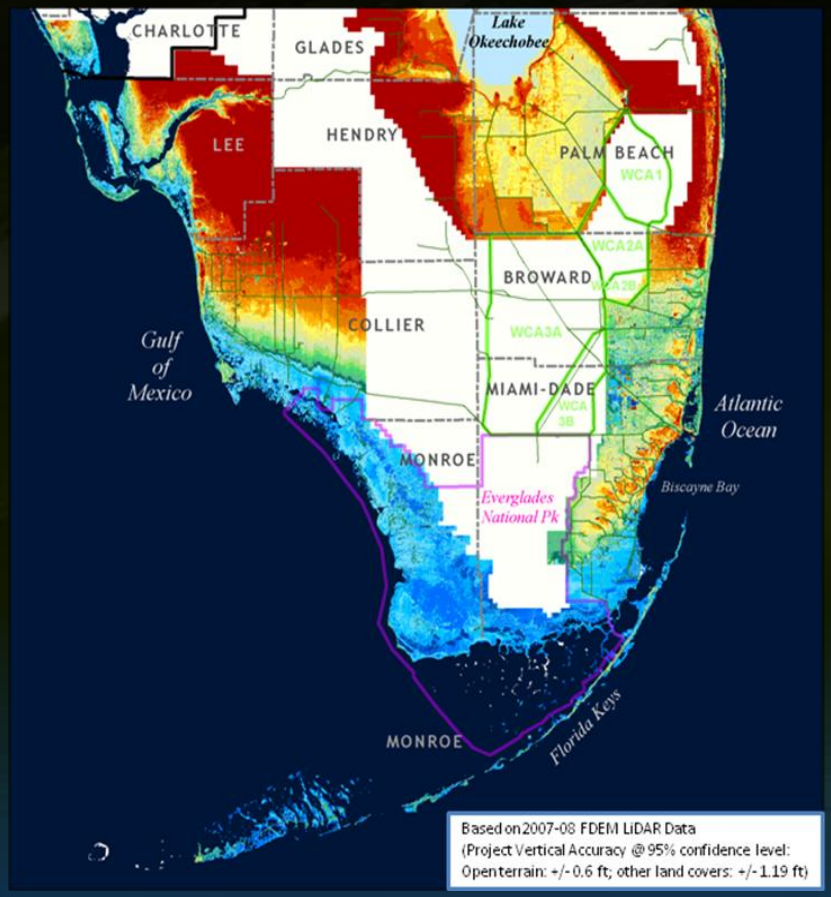


Water Supply and Water Conservation

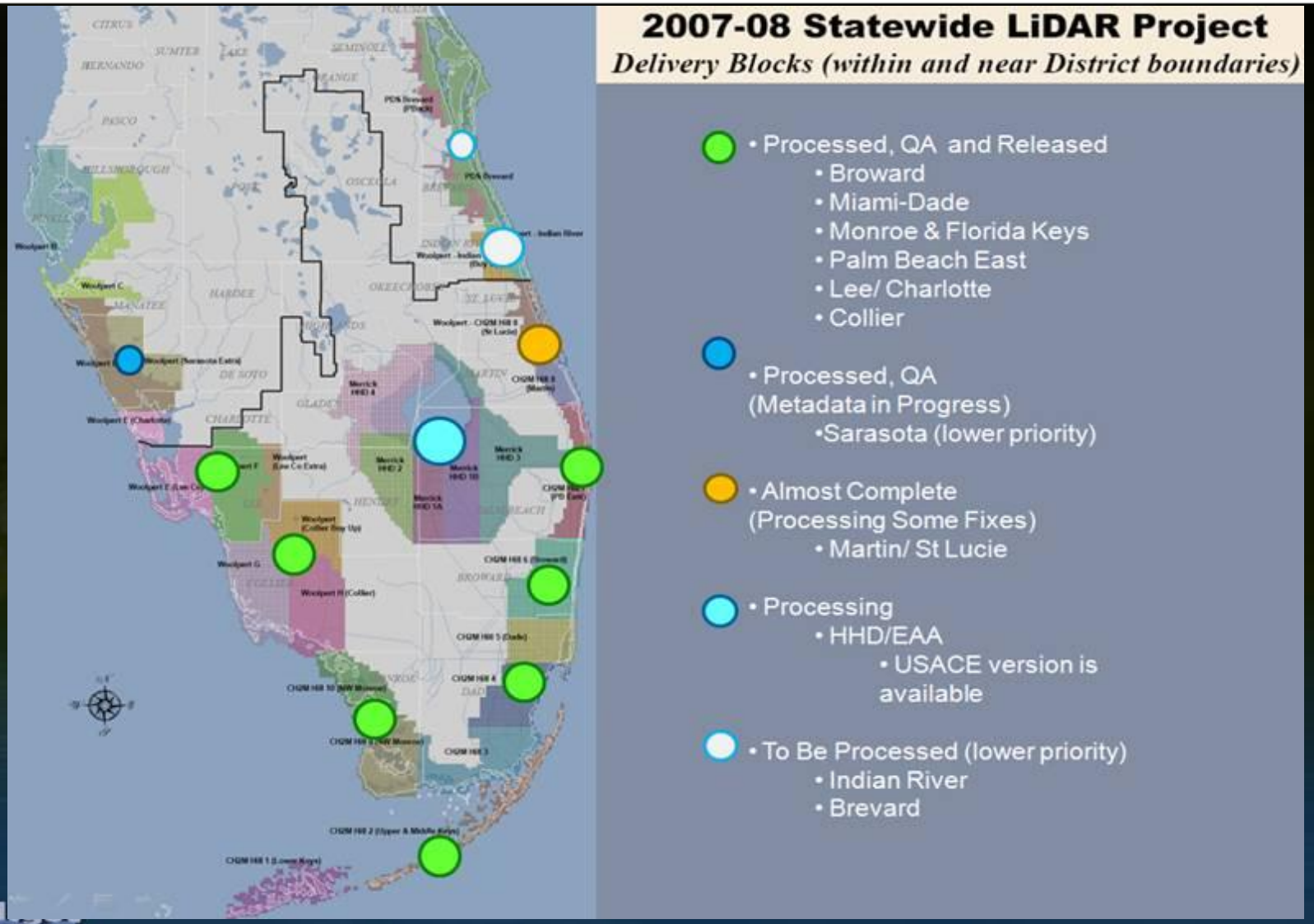
- Continue looking at opportunities and technologies to reduce amount of additional freshwater needed for water supply
- Look at opportunities to use reuse as a hydraulic barrier
- Implement water conservation measures
- Develop alternative water supply options

Flood Inundation Tools – Digital Elevation Maps (DEM) Project

- Improved support for operations and projects
- Hydrologic and hydraulic models
- Sea-level rise, storm surge, dike-failure study
- Ecological studies – plant communities vs. landscape position, black-mangrove die-off areas, etc.
- Identify historical features – river channels, logging trams, shell midden sites

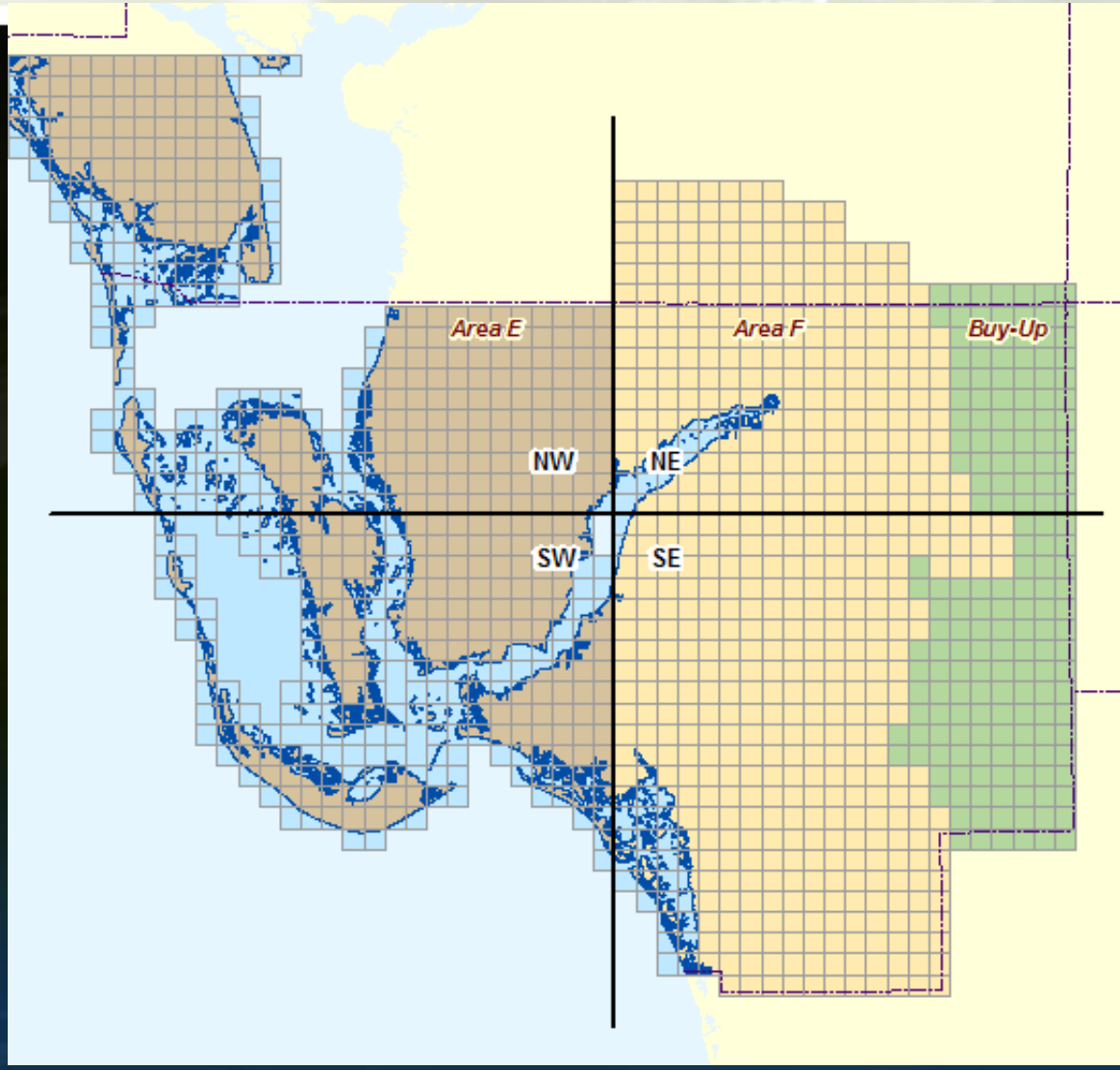


Status of Digital Elevation Maps (DEMs)



Example of DEM for Lee County

- 1,300 tiles
- Irregular boundaries between tiles
- Complex and time consuming



Regional Climate Change Initiatives

- Federal Initiatives: USEPA, NOAA, USGS, USACE

- Regional Planning Councils –
  - Local governments looking at Climate Change in Evaluation and Appraisal Report

- Department of Environmental Protection –
  - Water Supply Planning

Regional Climate Change Initiatives

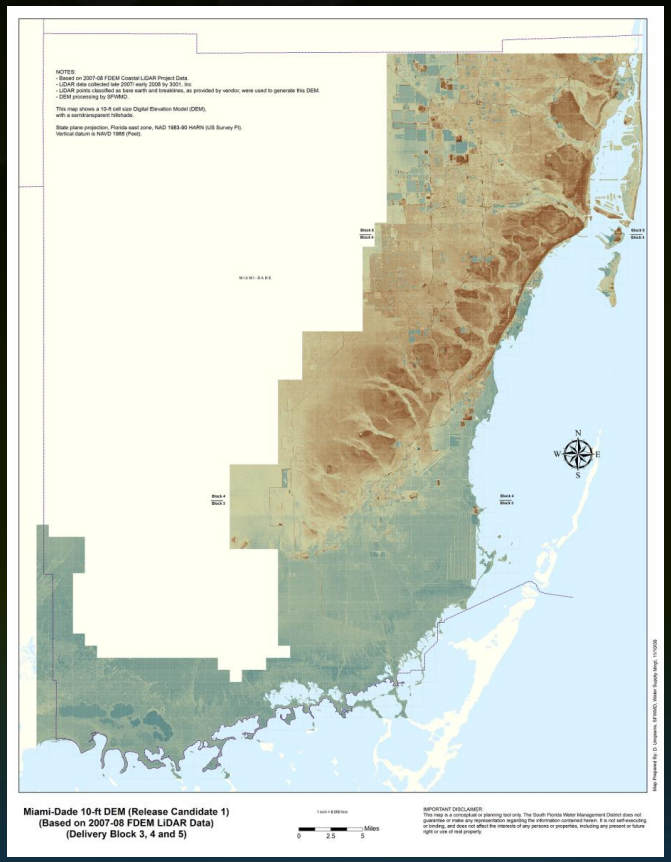
- **Southeast Florida Regional Climate Change Compact (Palm Beach, Broward, Miami-Dade, and Monroe)**
  - **Next summit – October 29**
  - **Unifying sea level rise projections**
  - **Common dataset for inundation mapping**
- **Florida Climate Institute**
  - **A joint venture between FSU & UF (and other universities)**
- **Dutch Consulate in Miami, is hosting a 3-day workshop titled " Climate Change and its Impact on Water Management"**

SOUTHEAST FLORIDA REGIONAL COMPACT CLIMATE CHANGE

Florida Climate Institute

Proposed Scope of Future SFWMD Efforts (FY11)

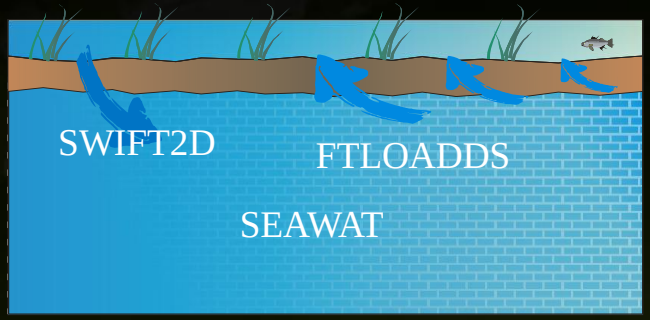
- Identify District projects that may be impacted by sea level rise
- Complete technical report on the trends in sea level rise and climate variability
- Complete development of standardized DEM datasets for coastal areas
- Complete evaluation of the existing saltwater intrusion monitoring network
- Complete annual baseline mapping of the saltwater interface



Miami-Dade 10-ft DEM (Release Candidate 1)
(Based on 2007-08 FDEM LiDAR Data)
(Delivery Block 3, 4 and 5)

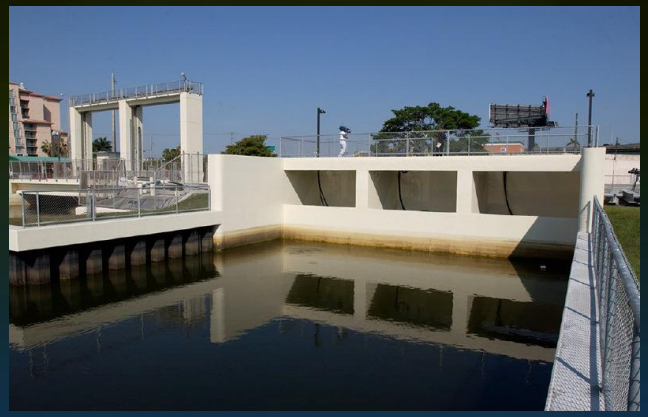
Proposed Scope of Future SFWMD Efforts (Cont.)

- **FY12**
  - **Initiate development of modeling tools for flood protection and saltwater intrusion in coastal watersheds ($200,000)**
  - **Complete the development of adaptation strategies for coastal spillway structures in Miami-Dade (S-27, S-28, S-29) that are vulnerable to sea level rise**
- **FY13**
  - **Initiate land acquisition (if necessary) and design of coastal pump stations**



Proposed Future Scope of SFWMD Efforts (Cont.)

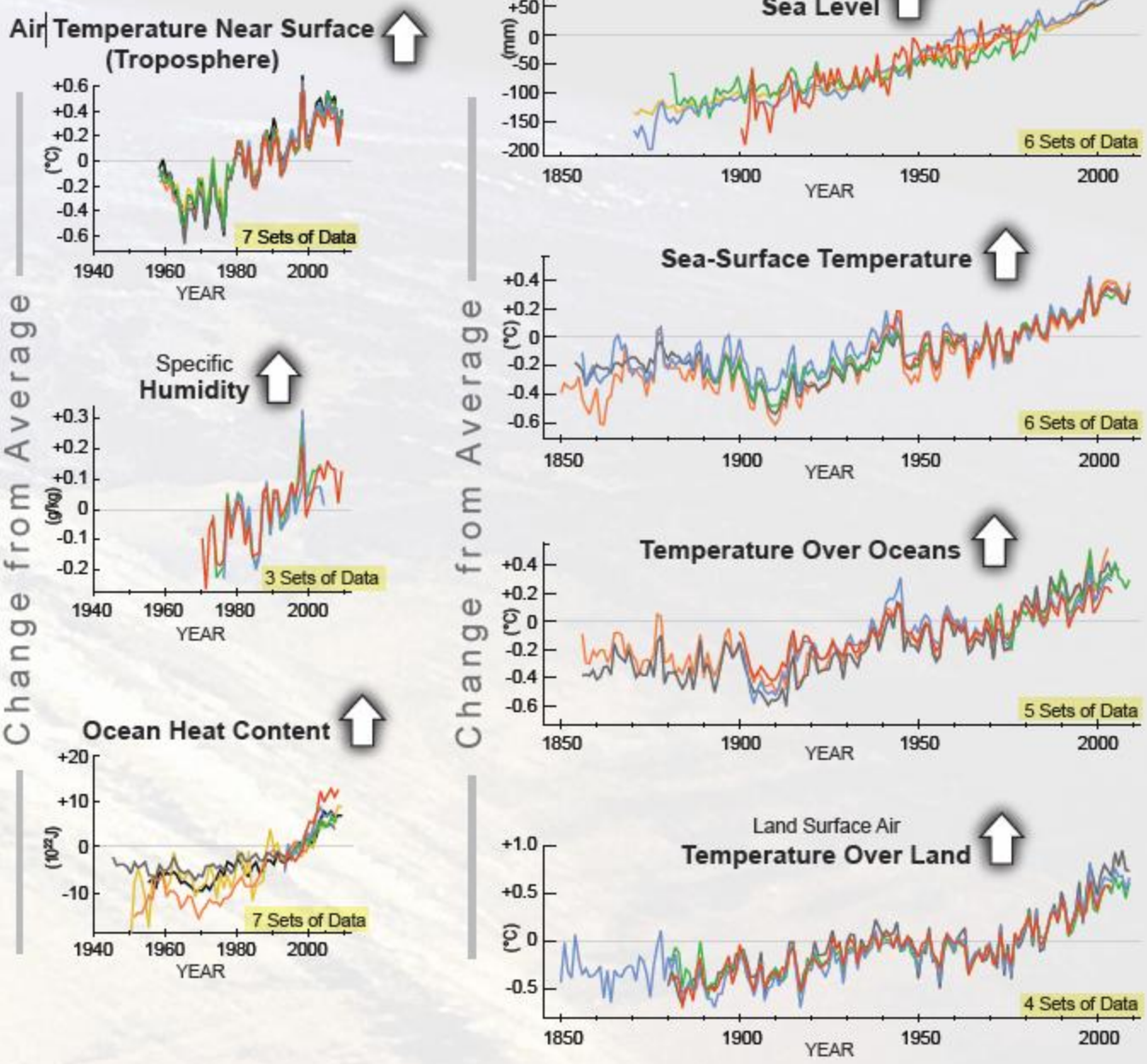
- **FY14**
  - Complete land acquisition (if necessary) and design for coastal pump stations
- **FY15**
  - Initiate the implementation of adaptation strategies for vulnerable structures




SOUTH FLORIDA WATER MANAGEMENT DISTRICT
Climate Change & Water Management in South Florida
Interdepartmental Climate Change Group
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida
November 12, 2009

Questions?

These indicators all increase in a warming world



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Signs of a warming world

Signs of a warming world

These indicators all decrease in a warming world